

XLV.—*Note on the Skeleton of a large Plesiosaur* (*Rhomaleosaurus thorntoni*, *sp. n.*) from the Upper Lias of Northamptonshire. By CHARLES W. ANDREWS, D.Sc., F.R.S. (British Museum, Natural History).

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[Plates VII.-IX.]

SOME years ago the skeleton of a very large Plesiosaur was discovered in the Upper Liassic beds of Kingsthorpe, Northamptonshire, and, although unfortunately some portions were lost before the value of the find was recognised, the remaining bones were collected by H. Gerard Thornton, Esq., of Kingsthorpe Hall, who has presented them to the British Museum. The portions of the skeleton preserved are: the anterior part of the skull and the greater part of the mandible, about 14 cervical, 3 thoracic, 24-25 dorsal, 4-5 sacral, and 17 caudal vertebræ (many of these are still united with one another), numerous portions of the ribs, and, most important of all, the nearly complete limb-girdles with the humeri and femora—the distal portions of the paddles are wanting. All the bones preserved are in very good condition, and are remarkable for their massive solidity.

The Skull.—Unfortunately, only the anterior portion of the skull is preserved: on the right side the lateral portions as far back as a point some distance behind the orbit are preserved, the maxilla, transpalatine, and anterior portion of the jugal being present; on the left side this portion is wanting, the maxilla being broken off obliquely some distance in front of the external nasal opening.

In a general way the skull seems to have resembled that of *Rhomaleosaurus cramptoni*, Carte and Baily*, *sp.*, an almost complete skeleton of which was obtained from the Kettlewell Alum Works (Upper Lias), near Whitby, and is now preserved in the Museum of Science and Art, Dublin. A cast of this specimen is exhibited in the Fossil Reptile Gallery of the British Museum. Certain differences between the skull of this specimen and that now described will be noted below.

The snout is broad and depressed, and the premaxillary region is strongly marked off by a broad notch, deepest at the point where the maxillo-premaxillary sutures cross

* Journ. Roy. Dublin Society, vol. iv. p. 160 (1866).

the alveolar border. From this point these sutures run first obliquely upwards and backwards, then backwards parallel to one another, and forming the outer borders of the transversely arched and greatly elongated facial processes of the premaxillæ, which extend far back behind the external nares to the broken end of the fragment. They are divided by a median suture.

The alveolar border of the maxilla is broadly convex in its anterior portion, then beneath the point of the orbit it becomes concave, behind which it is nearly straight, extending some distance behind the orbits. The external nasal opening is about opposite the middle of the convex portion of the maxilla, and much further in front of the orbits than in *Rhomaleosaurus cramptoni*: the distance between these openings and the tip of the snout is about 31 cm.; probably the nasals and prefrontals took part in the formation of their borders, but the crushing undergone by the specimen renders this region obscure. The ventral border of the orbit is formed anteriorly by the maxilla and posteriorly by the jugal. At its hinder end the inner border of the maxilla joins a massive bone with a strong downwardly directed tuberosity; this is the transpalatine, and probably a portion of the pterygoid is united with it. Anteriorly this bone and the maxillary are separated by a notch with a rounded border, presumably the posterior edge of a suborbital vacuity.

The middle of the palatal surface of the anterior expansion of the snout is occupied by a forward extension of the vomers, which nearly reach the alveolar border, and are bounded by ridges on the premaxillæ. Behind this the vomers widen out, first joining the maxillæ and then separating the internal nares by a broad, transversely convex bar of bone: the posterior end of these openings is about opposite the hinder wall of the alveolus of the fourth maxillary tooth. Behind the nares the vomers widen out, and, no doubt, united with the anterior ends of the pterygoids: probably the palatines extended between these latter and the maxillæ, extending forwards to reach the narial openings, but the sutures are here obscure.

The first premaxillary tooth is small and close to the middle line, then come three greatly enlarged teeth, and, lastly, just in front of the maxillo-premaxillary suture a smaller one. The first tooth in the maxilla is also small, then come five very large ones, occupying the convex portion of the alveolar border: behind these there is a series of about fourteen smaller teeth, diminishing in size

from before backwards and extending some distance behind the orbit. The upper teeth seem to have had a slight anterior and posterior carina, but otherwise their crown, which is circular in section, is nearly smooth.

The Mandible.—Like the skull the mandible is, unfortunately, very incomplete. On the right side the ramus is preserved as far back as the end of the dentigerous portion; on the left side, while much of the middle portion of the ramus is wanting, the massive articular and angular region is preserved.

The symphyseal region is greatly widened out, the expansion extending a little behind the symphysis to the socket of the sixth tooth. The splenials extend a short distance into the symphysis, the ventral surface of which is much roughened and perforated by numerous vascular foramina. Behind this expanded portion the ramus is comparatively slender. The articular region is extraordinarily massive, and has the distal portion of the quadrate still articulating with it; the angular process is broken away. The anterior expansion of the mandible bears six teeth on each side. The anterior tooth is comparatively small, and is followed by four large ones, the sixth being again small. Behind the expansion there were about twenty-five small teeth—these diminish in size towards the back of the jaw; in several cases alternate sockets are empty. The crowns of the teeth are circular in section, and their enamel surface bears numerous sharp plications running towards the top of the crown.

Vertebral Column.—The cervical region is represented by nine separate centra, free from the matrix and wanting the arches, and four united with one another, with the arches and zygapophyses present, but the neural spines lost: the last of these seems to be the posterior cervical, the rib-head having a slight contact with the incipient diapophysis of the neural arch. The atlas and axis are lost. The centra of the cervicals are much shorter than wide, and a little wider than high. The length of the centrum in the mid-ventral line is rather greater than at the neural canal. The nearly circular articular surface is moderately deeply concave, and its edges are rounded off. The facets for the ribs are distinctly divided into an upper and a lower portion by a ridge. The ventral surface between the rib-facets is perforated by a pair of large foramina separated by a rounded hæmal ridge.

The neural arches are massive, and the zygapophyses are very large, with nearly circular articular surfaces which

are almost horizontal ; the anterior and posterior facets are about in the same plane, and the processes bearing them are separated by a well-defined rounded notch. The base of the neural arch extends the whole length of the centrum, and the neural arch is nearly circular in outline.

In the three thoracic vertebræ the rib-articulations pass upwards on to the arch ; in them the zygapophysial articulations become more oval in outline, and are more inclined to the horizontal plane. Passing back along the dorsal series, which seems to have included twenty-four vertebræ in front of the sacrum, the transverse processes rise rapidly on the arch, at the same time the zygapophyses become more inclined and relatively smaller, and towards the posterior portion of the series their anterior and posterior articular surfaces become concave and convex respectively. The base of the neural arch is not so long from before backwards as in the cervical region. The transverse processes are very massive, and terminate in a thickened convex extremity, which is higher than wide and was evidently capped with cartilage in life ; on the ventral surface of these processes close to their point of origin there is a deep pit. The posterior transverse processes are more inclined backwards than those in front. Towards the hinder end of the series the centra become higher than wide. In this Plesiosaur the sacrum (Pl. VII.) seems remarkably well developed for an aquatic animal. The sacral vertebræ are four or five in number : in them the transverse processes are very short, forming prominences borne both on the arch and centrum ; these articular surfaces for the sacral ribs are large, being very considerably wider above than below—the second, third, and fourth are the largest. In this region the neural spines were short from before backwards, and the small zygapophyses make an acute angle with the vertical plane. The sacral ribs are remarkably strongly developed. The first is a simple bar of bone, with a deepened and widened proximal end for union with the vertebra : at its outer end it thins, curves slightly backwards, and articulates with the anterior process of the second sacral rib ; on its anterior face towards the outer end it bears a strong cristiform ridge. The second sacral rib is the stoutest of the series : its proximal portion is compressed from before backwards, but at its outer end it widens out into a massive hammer-shaped head, the anterior arm of which unites with the first sacral rib, while the posterior arm joins the anterior limb of the similar hammer-shaped head borne by the third sacral rib, which, however, is here imperfectly preserved.

The outer face of the hammer-heads of both these ribs (2 and 3) is flattened, evidently for union of considerable closeness with the upper end of the ilium. The outer end of the fourth sacral rib is actually bifurcate, its anterior arm joining the backward process of the third, while the posterior probably joined a short stout rib, which may be regarded either as a fifth sacral or the first caudal. The articular faces of the sacral vertebrae are rather strongly concave, without the thickened and rounded border seen in the cervical centra: there seems to be no tendency for them to fuse with one another.

The caudal vertebrae have short centra with not very deeply concave articular ends, the borders of which are sharp. The facets for union with the caudal ribs are only slightly prominent in the front of the series, but become more so further back. The neural spines are short from before backwards.

The *shoulder-girdle* is chiefly remarkable for the massiveness of its constituent elements and for the shortness of the post-glenoid region of the coracoids.

The clavicular arch is, unfortunately, incomplete, but it can be seen that it consisted as usual of an interclavicle and a pair of clavicles, and that its anterior border was somewhat deeply concave; the visceral surface is slightly concave. The suture between the interclavicle and the clavicle is obscure, but probably the former was a comparatively small element confined to the front of the middle part of the arch, a portion of the suture on the right side seems to be shown on Pl. VIII. The outer end of the clavicle united with the anterior ventral prolongation of the scapula, and the suture between them is shown in Pl. VIII. The posterior border of the clavicular arch, no doubt, united with the front of the coracoids in the middle line. The scapulae are both imperfect, the anterior ventral ramus being broken away. The glenoid ramus of the scapula is immensely massive, and unites with the coracoid in a flat triangular sutural surface; the anterior border of this region forms a sharp edge, constituting the outer border of the coraco-scapular foramen. The dorsal ramus of the scapula rises nearly vertically from the ventral and glenoid rami, its nearly flat outer face being about at right angles to the ventral face of the bone. This dorsal ramus is extraordinarily massive, being some 5 centimetres thick in the middle; its inner face is convex transversely.

The *coracoids* are chiefly remarkable for the shortness of their post-glenoid region. The glenoid region is very

massive and much thickened, the visceral surface between the articulations being strongly convex from before backwards, so that the symphysial surface is here very deep. Anterior to this the bones are thin, and no doubt in front united with the posterior border of the clavicular arch. Towards their posterior ends also the coracoids become quite thin. The general form of the bones of the shoulder-girdle will be best understood from Pl. VIII.

The *humerus* has a long straight shaft with a broad distal expansion, chiefly on the posterior side, so that the anterior border of the bone is nearly straight. The head and tuberosity are well developed, and all the impressions for the attachment of muscles are strongly marked, so that the animal was probably adult. The bone, as a whole, is proportionately very large; it is considerably larger than the femur, while in *Rhomaleosaurus cramptoni* the reverse is said to be the case*.

The Pelvis (Pl. IX.).—The *pubes* are imperfectly preserved, but enough is present on one side or the other to permit of a satisfactory restoration. Their broad blade has a strongly convex anterior border, while posteriorly it is deeply notched by the anterior border of the obturator foramen. The acetabular process for union with the ischium is very long. In the middle line the pubes united in a long symphysis, but diverged posteriorly, being probably united by cartilage with one another and with the ischia—probably they had a junction with these latter, completely enclosing the obturator foramina.

The *ischia* are very massive bones: their acetabular processes for union with the pubes are very long and sharply defined. The visceral surface of the united ischia is convex from before backwards in front and concave behind; posteriorly these bones seem to have been abruptly truncated. The obturator foramen is an elongated oval in outline, its long axis being nearly antero-posterior. The *ilia* are straight bones expanding towards their extremities; the upper expansion is considerable and is flattened, its inner face must have united with some at least of the sacral ribs, probably by a ligamentous union. As in the case of the shoulder-girdle, the pelvis is remarkable for the massive solidity of its constituent elements.

The *femur* is a nearly straight bone with a distal expansion, differing from that of the humerus in being equally

* Lydekker, Catal. Foss. Rept. Brit. Mus. pt. ii. p. 161 (1889).

developed anteriorly and posteriorly, so that the median long axis of the bone divides it equally; it is also smaller than in the humerus. The head, trochanter, and muscle-impressions are well developed. The rest of the hind paddle is unknown.

As already noticed, this *Plesiosaur* seems to resemble most nearly that of which the skeleton is described and rather badly figured by Carte and Baily* under the name of *Plesiosaurus cramptoni*. It is very unfortunate that this fine skeleton has never been properly prepared and developed, so that the shoulder and pelvic girdles are almost completely hidden in matrix and consequently are not available for comparison with the present specimen. The general proportions of the skull and vertebral column seem to be much the same in both, but there are several differences which indicate that the two are not specifically identical. Thus in the skull of our specimen the external nasal openings are situated considerably in front of the orbits, while in *P. cramptoni* they are scarcely at all in advance of them. Again, the form of the platform of the neural arch in the cervical vertebræ, with their nearly horizontal zygapophyses, is very different from that of the cervical vertebra figured by Carte and Baily, in which the zygapophysial surfaces are strongly inclined. Furthermore, in the Northampton specimen the humerus is relatively considerably larger than in *P. cramptoni*, and its distal extremity is more expanded. It seems therefore that our specimen should be regarded as at least specifically different from *P. cramptoni*. This species was referred by Prof. H. G. Seeley† to a distinct genus, *Rhomaleosaurus*, giving, however, somewhat inadequate reasons for this. I propose to adopt the generic name *Rhomaleosaurus*, and define the genus as follows:—

Plesiosaurs with a relatively large head and short neck (the proportions being as five to eight). Cervical vertebræ with very short centra and a divided rib-facet. Well-developed sacrum. Shoulder-girdle with strongly developed clavicular arch with broadly concave anterior border; coracoids short in post-glenoid region. Pelvis with a comparatively short pubis, an elongated oval obturator foramen, and a posteriorly truncated ischium. The present species I propose to call *Rhomaleosaurus thorntoni*, sp. n., in honour of H. Gerard Thornton, Esq., who collected the remains and presented them to the British Museum.

* *Loc. cit. supra.*

† *Quart. Journ. Geol. Soc.* vol. xxx. p. 448 (1874).



SACRAL REGION OF VERTEBRAL COLUMN OF RHOMALEOSAURUS THORNTONI, sp. n.
About $\frac{1}{3}$ nat. size.